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HARVEYS LAKE, LUZERNE COUNTY, PENNSYLVANIA

Pacific Northwest Environmental
Research Laboratory

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June 1975

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NATIONAL EUTROPHICATION SURVEY

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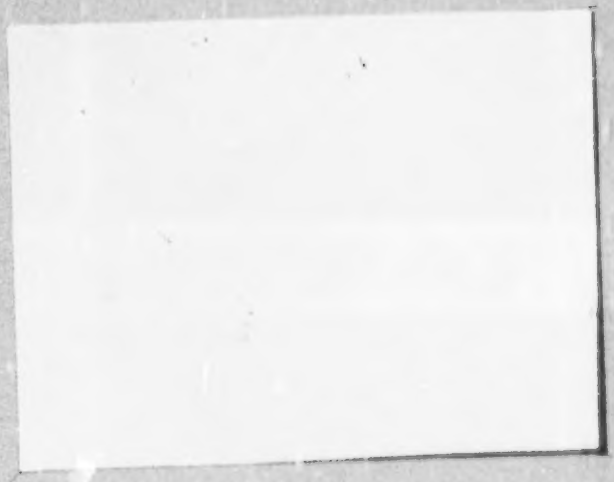

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

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REPORT
ON
HARVEYS LAKE
LUZERNE COUNTY
PENNSYLVANIA
EPA REGION III
WORKING PAPER No. 419

WITH THE COOPERATION OF THE
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
AND THE
PENNSYLVANIA NATIONAL GUARD

JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Pennsylvania Department of Environmental Resources for professional involvement and to the Pennsylvania National Guard for conducting the tributary sampling phase of the Survey.

Walter A. Lyon, Director of the Bureau of Water Quality Management, Richard M. Boardman, Chief of the Division of Water Quality, and James T. Ulanoski, Aquatic Biologist of the Division of Water Quality, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

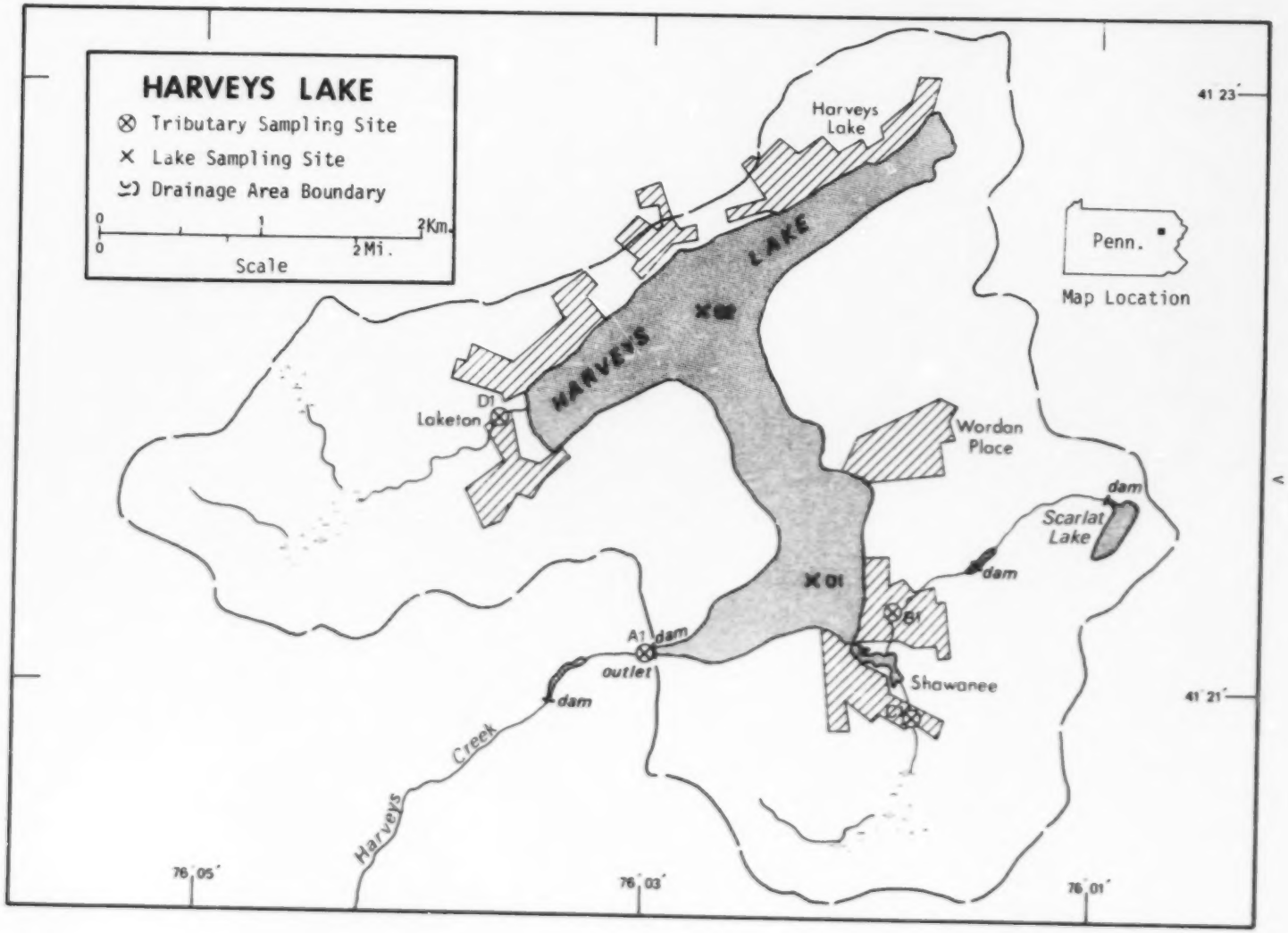
Major General Harry J. Mier, Jr., the Adjutant General of Pennsylvania, and Project Officer Major Ronald E. Wickard, who directed the volunteer efforts of the Pennsylvania National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF PENNSYLVANIA

LAKE NAME	COUNTY
Allegheny Reservoir	McKean, Warren, PA; Cattaraugus, NY
Beaver Run Reservoir	Westmoreland
Beltzville	Carbon
Blanchard Reservoir	Centre
Canadohta	Crawford
Conneaut	Crawford
Conewago (Pinchot)	York
Greenlane	Montgomery
Harveys	Luzerne
Indian	Somerset
Naomi	Monroe
Ontelaunee	Berks
Pocono	Monroe
Pymatuning Reservoir	Crawford, PA; Ashtabula, OH
Shenango River Reservoir	Mercer
Stillwater	Monroe
Wallenpaupack	Pike, Wayne


HARVEYS LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0 1 2Km.
0 2Mi.
Scale
Harveys Lake
HARVEYS LAKE
Penn.
Map Location
41 23'
D1
Laketon
Wordan Place
dam
Scarlat Lake
dam
01
A1
dam
outlet
dam
Shawanee
Harveys Creek
41 21'
76 05'
76 03'
76 01'

HARVEYS LAKE*

STORET NO. 4222

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Harveys Lake is mesotrophic. It ranked third in overall trophic quality when the 17 Pennsylvania lakes sampled in 1973 were compared using a combination of six parameters**. Six of the lakes had less median total phosphorus, five had less and three had the same median dissolved phosphorus, three had less median inorganic nitrogen, none had greater mean Secchi disc transparency, and six had less chlorophyll a. Marked depression of dissolved oxygen with depth occurred at both sampling stations in October, 1973.

Survey limnologists observed rooted aquatic vegetation along the shorelines near both stations in July.

B. Rate-Limiting Nutrient:

Results of the algal assay indicate phosphorus limitation at the time the sample was collected (04/12/73). The lake data indicate phosphorus limitation at the other sampling times as well.

C. Nutrient Controllability:

1. Point sources--There were no known municipal sewage treatment plants impacting Harveys Lake during the sampling year. Septic

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* Table of metric conversions--Appendix A.
** See Appendix B.

tanks were estimated to have contributed about 16% of the total phosphorus load, but a detailed study would be required to determine the actual magnitude of these phosphorus inputs.

During the sampling year, Harveys Lake received a total phosphorus load at a rate less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic rate but more than his suggested oligotrophic rate; i.e., a mesotrophic rate (see page 12). Because the lake is mesotrophic at this time, every effort should be made to prevent any significant increase in the existing loading rate.

2. Non-point sources--Non-point sources, including precipitation, contributed about 84% of the total phosphorus load to Harveys Lake. The phosphorus exports of the unnamed creeks B-1, C-1, and D-1 (see page 12) were substantially greater than the exports of unimpacted Pennsylvania streams studied elsewhere. The greater rates may be due to septic tank discharges, unidentified point-source wastes, drainage from the urbanized areas around the lake, or to land-use practices in the lake drainage system.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 2.67 kilometers^2.
2. Mean depth: 11.0 meters.
3. Maximum depth: 29.3 meters.
4. Volume: 29.370 x 10^6 m^3.
5. Mean hydraulic retention time: 1.6 years.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Creek (B-1)	1.4	<0.1
Unnamed Creek (C-1)	2.8	0.1
Unnamed Creek (D-1)	2.3	0.1
Minor tributaries & immediate drainage -	8.1	0.4
Totals	14.6	0.6

2. Outlet -

Harveys Creek	17.3**	0.6

C. Precipitation***:

1. Year of sampling: 89.1 centimeters.
2. Mean annual: 97.8 centimeters.

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† Ulanoski, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Harveys Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 19.8 meters at station 1 and 25.6 meters at station 2.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR HARVEY'S LAKE
STORET CODE 4222

PARAMETER	1ST SAMPLING (4/12/73) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/23/73) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/ 2/73) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	6.6 - 6.8	6.8	6.8	6.9 - 26.0	18.0	22.3	7.0 - 17.8	12.5	11.6
DISS OXY (MG/L)	11.9 - 12.1	12.0	12.0	5.0 - 10.7	7.9	8.4	0.5 - 8.4	4.0	2.1
CNDCTVY (MCROMO)	100. - 105.	100.	100.	62. - 94.	80.	89.	66. - 85.	77.	83.
PH (STAND UNITS)	8.5 - 8.7	8.6	8.6	6.3 - 7.7	6.9	7.1	6.2 - 7.0	6.5	6.3
TOT ALK (MG/L)	15. - 24.	18.	16.	20. - 31.	24.	23.	19. - 28.	21.	21.
TOT P (MG/L)	0.012 - 0.024	0.016	0.015	0.007 - 0.028	0.011	0.010	0.013 - 0.054	0.023	0.020
ORTHO P (MG/L)	0.004 - 0.011	0.006	0.005	0.002 - 0.014	0.006	0.006	0.004 - 0.018	0.008	0.008
NO2+NO3 (MG/L)	0.120 - 0.140	0.123	0.120	0.040 - 0.240	0.093	0.050	0.040 - 0.320	0.138	0.100
AMMONIA (MG/L)	0.040 - 0.070	0.044	0.040	0.040 - 0.200	0.087	0.065	0.040 - 0.360	0.098	0.060
KJEL N (MG/L)	0.200 - 0.800	0.360	0.300	0.200 - 0.400	0.317	0.300	0.200 - 0.600	0.285	0.200
INORG N (MG/L)	0.160 - 0.210	0.167	0.160	0.080 - 0.380	0.181	0.120	0.090 - 0.480	0.236	0.180
TOTAL N (MG/L)	0.320 - 0.920	0.483	0.420	0.240 - 0.640	0.410	0.400	0.240 - 0.660	0.423	0.410
CHLRPYL A (UG/L)	5.4 - 5.5	5.4	5.4	5.7 - 9.0	7.3	7.3	3.9 - 6.3	5.1	5.1
SECCHI (METERS)	3.0 - 3.0	3.0	3.0	5.5 - 5.8	5.6	5.6	3.3 - 4.0	3.7	3.7

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/12/73	1. Asterionella	2,097
	2. Flagellates	198
	3. Cryptomonas	63
	4. Fragilaria	31
	5. Cyclotella	21
	Other genera	20
	Total	2,430
07/23/73	1. Aphanizomenon (?)	299
	2. Flagellates	193
	3. Cryptomonas	140
	4. Microcystis	88
	5. Ceratium	88
	Other genera	158
	Total	966
10/02/73	1. Cryptomonas	75
	2. Coelosphaerium	50
	3. Anabaena	25
	4. Ceratium	25
	5. Gloeocystis	25
	Other genera	37
	Total	237

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
04/12/73	01	5.5
	02	5.4
07/23/73	01	9.0
	02	5.7
10/02/73	01	6.3
	02	3.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.008	0.160	0.2
0.050 P	0.058	0.160	4.6
0.050 P + 1.0 N	0.058	1.160	18.9
1.0 N	0.008	1.160	0.1

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential primary productivity of Harveys Lake was moderately low at the time of sampling (04/12/73). Also, the increased yield with the addition of orthophosphorus alone, and the lack of response to only nitrogen, shows that the lake was phosphorus limited when sampled.

The lake data indicate phosphorus limitation at the other sampling times as well. The mean N/P ratios were 30/1 in July and October, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Pennsylvania National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in May, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Pennsylvania District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient exports, in $kg/km^2/year$, of the unnamed streams at stations B-1, C-1, and D-1 and multiplying the means by the ZZ area in km^2.

There were no wastewater treatment plants impacting the lake. Nutrient loads from septic tanks serving lakeshore dwellings were estimated at 0.1134 kg P and 4.263 kg N/capita/year.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek (B-1)	30	4.2
Unnamed Creek (C-1)	130	18.2
Unnamed Creek (D-1)	100	13.9
b. Minor tributaries & immediate drainage (non-point load) -	295	41.3
c. Known municipal STP's - None	-	-
d. Septic tanks* -	115	16.1
e. Known industrial - None	-	-
f. Direct precipitation** -	45	6.3
Total	715	100.0

2. Outputs -

Lake outlet - Harveys Creek 205

3. Net annual P accumulation - 510 kg.

* Estimate based on 400 shoreline dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek (B-1)	475	2.6
Unnamed Creek (C-1)	2,375	12.8
Unnamed Creek (D-1)	2,435	13.2
b. Minor tributaries & immediate drainage (non-point load) -	6,065	32.8
c. Known municipal STP's - None	-	-
d. Septic tanks* -	4,265	23.0
e. Known industrial - None	-	-
f. Direct precipitation** -	2,885	15.6
Total	18,500	100.0

2. Outputs -

Lake outlet - Harveys Creek 15,960

3. Net annual N accumulation - 2,540 kg.

* Estimate based on 400 shoreline dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Unnamed Creek (B-1)	21	339
Unnamed Creek (C-1)	46	848
Unnamed Creek (D-1)	43	1,059

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.27	0.19	6.9	1.0

Vollenweider loading rates for phosphorus (g/m²/yr) based on mean depth and mean hydraulic retention time of Harveys Lake:

"Dangerous" (eutrophic rate)	0.50
"Permissible" (oligotrophic rate)	0.25

V. LITERATURE REVIEWED

Ketelle, Martha J., and Paul D. Uttormark, 1971. Problem lakes in the United States. EPA Water Poll. Contr. Res. Ser., Proj. #16010 EHR, Washington, D.C.

Ulanoski, James, 1975. Personal communication (lake morphometry). PA Dept. Env. Resources, Harrisburg.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VII. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4224	LAKE NAOMI	445
2	4220	BELTZVILLE DAM	423
3	4222	HARVEY'S LAKE	413
4	4228	STILLWATER LAKE	401
5	4227	POCONO LAKE	389
6	4223	INDIAN LAKE	388
7	3641	ALLEGHENY RESERVOIR	385
8	4229	LAKE WALLENPAUPACK	371
9	4221	CANADOHTA LAKE	369
10	4219	BEAVER RUN RESERVOIR	360
11	4204	CONNEAUT LAKE	307
12	4226	PINCHOT LAKE	256
13	4213	PYMATUNING RESERVOIR	206
14	4216	SHENANGO RIVER RESERVOIR	157
15	4225	ONTELAUNEE DAM	101
16	4201	BLANCHARD RESERVOIR	85
17	4207	GREENLANE DAM	53

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P	INDEX NO
3641	ALLEGHENY RESERVOIR	56 (9)	38 (6)	63 (10)	100 (16)	69 (11)	59 (8)	385
4201	BLANCHARD RESERVOIR	13 (2)	13 (2)	25 (4)	31 (5)	3 (0)	0 (0)	85
4204	CONNEAUT LAKE	44 (7)	63 (10)	69 (11)	56 (9)	34 (5)	41 (6)	307
4207	GREENLANE DAM	6 (1)	6 (1)	19 (3)	13 (2)	3 (0)	6 (1)	53
4213	PYMATUNING RESERVOIR	0 (0)	72 (11)	6 (1)	0 (0)	100 (16)	28 (4)	206
4216	SHENANGO RIVER RESERVOIR	19 (3)	44 (7)	13 (2)	6 (1)	47 (7)	28 (4)	157
4219	BEAVER RUN RESERVOIR	94 (15)	19 (3)	88 (14)	81 (13)	19 (2)	59 (8)	360
4220	BELTZVILLE DAM	88 (14)	25 (4)	94 (15)	94 (15)	34 (5)	88 (13)	423
4221	CANADOHTA LAKE	50 (8)	97 (15)	56 (9)	19 (3)	59 (9)	88 (13)	369
4222	HARVEY'S LAKE	63 (10)	81 (13)	100 (16)	63 (10)	47 (7)	59 (8)	413
4223	INDIAN LAKE	100 (16)	31 (5)	75 (12)	75 (12)	19 (2)	88 (13)	388
4224	LAKE NAOMI	81 (13)	88 (14)	44 (7)	69 (11)	88 (14)	75 (12)	445
4225	ONTELAUNEE DAM	25 (4)	0 (0)	0 (0)	44 (7)	19 (2)	13 (2)	101
4226	PINCHOT LAKE	31 (5)	56 (9)	31 (5)	38 (6)	81 (13)	19 (3)	256
4227	POCONO LAKE	38 (6)	97 (15)	50 (8)	88 (14)	75 (12)	41 (6)	389
4228	STILLWATER LAKE	72 (11)	72 (11)	38 (6)	25 (4)	94 (15)	100 (16)	401
4229	LAKE WALLENPAUPACK	72 (11)	50 (8)	81 (13)	50 (8)	59 (9)	59 (8)	371

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P
3641	ALLEGHENY RESERVOIR	0.016	0.380	414.250	3.700	13.800	0.006
4201	BLANCHARD RESERVOIR	0.064	1.300	453.143	15.187	14.900	0.046
4204	CONNEAUT LAKE	0.023	0.185	402.000	7.567	14.600	0.007
4207	GREENLANE DAM	0.066	1.475	460.222	24.011	14.900	0.020
4213	PYMATUNING RESERVOIR	0.070	0.180	467.750	56.333	7.700	0.008
4216	SHENANGO RIVER RESERVOIR	0.058	0.340	463.555	26.800	14.500	0.008
4219	BEAVER RUN RESERVOIR	0.009	0.835	384.833	5.183	14.800	0.006
4220	BELTZVILLE DAM	0.010	0.815	362.444	4.856	14.600	0.005
4221	CANADOHTA LAKE	0.020	0.130	436.000	19.167	14.100	0.005
4222	HARVEY'S LAKE	0.015	0.160	338.000	5.967	14.500	0.006
4223	INDIAN LAKE	0.008	0.520	400.222	5.211	14.800	0.005
4224	LAKE NAOMI	0.014	0.135	443.333	5.533	8.000	0.005
4225	ONTELAUNEE DAM	0.040	2.150	470.667	11.783	14.800	0.011
4226	PINCHOT LAKE	0.027	0.245	453.000	13.950	11.500	0.008
4227	POCONO LAKE	0.024	0.130	438.800	4.980	13.200	0.007
4228	STILLWATER LAKE	0.015	0.180	449.000	18.233	7.900	0.004
4229	LAKE WALLENPAUPACK	0.015	0.250	394.583	9.617	14.100	0.006

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4222 HARVEYS LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 17.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4222A1	17.3	0.57	0.59	0.85	0.82	0.79	0.42	0.42	0.40	0.37	0.42	0.57	0.65	0.57
422281	1.4	0.02	0.02	0.05	0.04	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.02
4222C1	2.8	0.06	0.06	0.08	0.08	0.08	0.05	0.05	0.05	0.04	0.05	0.06	0.07	0.06
4222D1	2.3	0.06	0.06	0.09	0.09	0.08	0.04	0.04	0.04	0.03	0.04	0.06	0.07	0.06
4222Z2	10.8	0.43	0.45	0.62	0.61	0.61	0.33	0.33	0.31	0.29	0.33	0.43	0.50	0.44

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 17.3
SUM OF SUB-DRAINAGE AREAS = 17.3
TOTAL FLOW IN = 6.88
TOTAL FLOW OUT = 6.88

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4222A1	5	73	0.74	19	0.76				
	6	73	0.37	23	0.07				
	7	73	0.28	21	1.13				
	8	73	0.09	25	0.03				
	9	73	0.02	22	0.09				
	10	73	0.09	27	0.05				
	11	73	0.18	17	0.14				
	12	73	1.19	15	0.62				
	1	74	0.65	12	0.25				
	2	74	0.34	9	0.31				
	3	74	0.74	23	0.99				
	4	74	0.96	20	0.48				
422281	5	73	0.03	19	0.06				
	6	73	0.03	23	0.01				
	7	73	0.01	21	0.00				
	8	73	0.01	25	0.00				
	9	73	0.01	22	0.00				
	10	73	0.00	27	0.00				
	11	73	0.01	17	0.01				
	12	73	0.05	15	0.03				
	1	74	0.04	12	0.01				
	2	74	0.02	9	0.01				
	3	74	0.05	23	0.15				
	4	74	0.13	20	0.02				

LAKE CODE 4222 HARVEYS LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4222C1	5	73	0.08	19	0.08				
	6	73	0.04	23	0.01				
	7	73	0.04	21	0.11				
	8	73	0.01	25	0.00				
	9	73	0.02	22	0.01				
	10	73	0.01	27	0.01				
	11	73	0.02	17	0.02				
	12	73	0.12	15	0.07				
	1	74	0.07	12	0.03				
	2	74	0.04	9	0.04				
	3	74	0.08	23	0.10				
	4	74	0.10	20	0.05				
4222D1	5	73	0.08	19	0.08				
	6	73	0.04	23	0.01				
	7	73	0.03	21	0.12				
	8	73	0.01	25	0.00				
	9	73	0.00	22	0.01				
	10	73	0.01	27	0.00				
	11	73	0.02	17	0.01				
	12	73	0.13	15	0.07				
	1	74	0.07	12	0.02				
	2	74	0.03	9	0.03				
	3	74	0.08	23	0.11				
	4	74	0.10	20	0.05				
4222Z2	5	73	0.57	19	0.59				
	6	73	0.28	23	0.00				
	7	73	0.22	21	0.88				
	8	73	0.07	25	0.02				
	9	73	0.02	22	0.07				
	10	73	0.07	27	0.03				
	11	73	0.14	17	0.11				
	12	73	0.41	15	0.48				
	1	74	0.54	12	0.21				
	2	74	0.26	9	0.24				
	3	74	0.54	23	0.74				
	4	74	0.71	20	0.34				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

422201
41 21 18.0 076 02 14.0
HARVEY'S LAKE
42079 PENNSYLVANIA

11EPALES
3

2111202
0064 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/12	09 45	0000	6.8		120	105	8.60	16	0.060	0.700	0.140	0.006
	09 45	0006	6.8	12.1		100	8.50	16	0.040	0.200	0.120	0.008
	09 45	0015	6.8	12.1		100	8.50	15	0.040	0.200	0.120	0.011
	09 45	0025	6.8	12.0		100	8.50	15	0.040	0.200	0.120	0.005
	09 45	0035	6.8	12.0		100	8.50	15	0.040	0.800	0.120	0.005
	09 45	0040	6.8	12.0		100	8.50	15	0.040	0.600	0.120	0.008
	09 45	0060	6.6	12.0		100	8.50	24	0.040	0.700	0.130	0.005
73/07/23	14 55	0000	25.4		228	93	7.20	31	0.070	0.400	0.050	0.006
	14 55	0005	25.0	8.4		93	7.10	31	0.070	0.200	0.050	0.005
	14 55	0015	24.2	8.5		92	7.20	30	0.040	0.300	0.040	0.006
	14 55	0025	14.6	10.7		64	7.10	30	0.060	0.200	0.060	0.006
	14 55	0040	7.8	6.8		64	6.40	23	0.130	0.300	0.160	0.006
	14 55	0063	7.2	5.0		62	6.30	21	0.200	0.400	0.180	0.011
73/10/02	16 10	0000	17.7	8.2	130	84	7.00	19	0.070	0.600	0.060	0.018
	16 10	0010	17.6	8.4		84	6.70	19	0.060	0.300	0.040	0.008
	16 10	0024	17.1	6.8		83	6.60	19	0.070	0.200	0.050	0.007
	16 10	0035	8.9	1.8		69	6.20	19	0.040	0.200K	0.210	0.008
	16 10	0050	7.7	1.2		67	6.20	19	0.050	0.200K	0.290	0.009
	16 10	0065	7.3	0.5		83	6.20	18	0.360	0.500	0.100	0.012

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/01/27

422201
41 21 18.0 076 02 14.0
HARVEY'S LAKE
42079 PENNSYLVANIA

11EPALES
3

2111202
0004 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/12	09 45	0000	0.023	5.5
	09 45	0006	0.019	
	09 45	0015	0.014	
	09 45	0025	0.014	
	09 45	0035	0.015	
	09 45	0040	0.014	
	09 45	0060	0.018	
73/07/23	14 55	0000	0.012	4.0
	14 55	0005	0.010	
	14 55	0015	0.007	
	14 55	0025	0.010	
	14 55	0040	0.010	
	14 55	0063	0.028	
73/10/02	16 10	0000	0.026	6.3
	16 10	0010	0.018	
	16 10	0024	0.020	
	16 10	0035	0.019	
	16 10	0050	0.021	
	16 10	0065	0.037	

25

STORET RETRIEVAL DATE 75/01/27

422202
41 22 12.0 076 02 44.0
HARVEY'S LAKE
42079 PENNSYLVANIA

11EPALES
3

2111202
0083 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/12	10 25	0000			120	100	8.60	21	0.070	0.300	0.140	0.005
	10 25	0006		11.9		100	8.60	20	0.040	0.200	0.120	0.005
	10 25	0015	6.8	11.9		100	8.50	20	0.040	0.300	0.120	0.007
	10 25	0025	6.8	11.9		100	8.70	19	0.040	0.200	0.120	0.004
	10 25	0040	6.8	12.0		100	8.70	19	0.050	0.200	0.120	0.004
	10 25	0055	6.8	12.0		100	8.70	18	0.040	0.300	0.120	0.005
	10 25	0070	6.8	12.0		100	8.60	16	0.040	0.200	0.120	0.004
	10 25	0079	6.7	12.0		100	8.70	16	0.040	0.300	0.120	0.004
73/07/23	15 25	0000	26.0		216	94	7.30	20	0.060	0.400	0.050	0.002
	15 25	0005	25.7	8.5		94	7.20	20	0.050	0.200	0.040	0.006
	15 25	0015	24.2	8.6		90	7.20	20	0.060	0.300	0.050	0.005
	15 25	0025	20.4	10.2		87	7.70	21	0.060	0.300	0.050	0.005
	15 25	0040	8.1	6.8		62	6.40	22	0.110	0.400	0.150	0.002
	15 25	0070	6.9	5.3		62	6.30	24	0.140	0.400	0.240	0.014
73/10/02	16 45	0000	17.8	6.4	158	83	6.70	20	0.060	0.300	0.040	0.008
	16 45	0015	17.8	8.2		85	6.80	21	0.050	0.200	0.040	0.005
	16 45	0025	16.6	5.6		83	6.50	21	0.090	0.200K	0.050	0.005
	16 45	0030	11.6	2.0		73	6.30	21	0.050	0.200K	0.130	0.005
	16 45	0040	8.2	2.1		67	6.30	21	0.050	0.200K	0.260	0.004
	16 45	0060	7.4	0.8		66	6.20	21	0.050	0.200K	0.320	0.006
	16 45	0084	7.0	0.5		73	6.30	23	0.270	0.400	0.210	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

26

STORET RETRIEVAL DATE 75/01/27

422202
41 22 12.0 076 02 44.0
HARVEY'S LAKE
42079 PENNSYLVANIA

11EPALES 2111202
3 0083 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/12	10 25	0000	0.013	5.4
	10 25	0006	0.024	
	10 25	0015	0.015	
	10 25	0025	0.016	
	10 25	0040	0.017	
	10 25	0055	0.014	
	10 25	0070	0.015	
	10 25	0079	0.012	
73/07/23	15 25	0000	0.008	5.7
	15 25	0005	0.007	
	15 25	0015	0.009	
	15 25	0025	0.010	
	15 25	0040	0.007	
	15 25	0070	0.019	
73/10/02	16 45	0000	0.018	3.9
	16 45	0015	0.022	
	16 45	0025	0.019	
	16 45	0030	0.018	
	16 45	0040	0.013	
	16 45	0060	0.020	
	16 45	0084	0.054	

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/02/03

422241
41 20 45.0 076 03 30.0
HARVEYS CREEK
42039 7.5 HARVEYS LAKE
O/HARVEYS LAKE
HWY 415 BRDG JUST BELO DAM
11EPALES 2111204
4 6000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	10 10		0.063	0.260	0.010	0.005K	0.015
73/06/17	10 00		0.028	0.480	0.029	0.005K	0.025
73/07/21	08 35		0.033	0.420	0.031	0.005K	0.015
73/08/25	10 30		0.011	0.370	0.020	0.005K	0.015
73/09/22	08 10		0.021	0.300	0.024	0.005K	0.010
73/10/27	09 35		0.130	1.150	0.044	0.030	
73/11/17	09 35		0.044	0.700	0.032	0.005K	0.005K
73/12/16	11 20		0.140	0.400	0.052	0.008	0.015
74/02/04	15 15		0.140	0.300	0.035	0.010	0.010
74/02/12	09 15		0.144	0.500	0.090	0.005K	0.005
74/02/22	11 50		0.132	0.400	0.050	0.015	
74/03/09	09 00		0.168	3.250	0.105	0.005	0.010
74/03/23	09 05		0.144	0.700	0.075	0.005K	0.010
74/04/13	09 15		0.096	1.500	0.040	0.005K	0.017

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

422281
41 21 02.0 076 01 50.0
UNNAMED CREEK
42 7.5 HARVEYS LAKE
T/HARVEYS LAKE
UNDRY RD #40027 CULVERT IN SHAWANESE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	11 00		0.048	0.340	0.024	0.015	0.070
73/06/17	09 45		0.310	0.380	0.050	0.026	0.050
73/07/21	08 10		0.390	0.370	0.032	0.035	0.060
73/08/25	10 10		0.570	0.780	0.067	0.138	0.160
73/09/22	07 30		0.189	0.600	0.039	0.020	0.055
73/10/27	09 15		0.023	1.600	0.252	0.021	0.175
73/11/17	09 00		0.232	0.400	0.036	0.024	0.035
73/12/16	10 40		0.112	0.900	0.044	0.012	0.025
74/02/04	15 00		0.208	0.200	0.045	0.040	
74/02/12	09 50		0.540	0.500	0.120	0.010	0.025
74/02/22	11 15		0.200	0.600	0.105	0.015	0.100
74/03/09	09 25		0.252	1.400	0.100	0.010	0.020
74/03/23	09 30		0.168	0.600	0.055	0.010	0.030
74/04/13	09 00		0.100	0.500	0.037	0.010	0.030

STORET RETRIEVAL DATE 75/02/03

4222C1
41 21 50.0 076 03 35.0
UNNAMED CREEK
42 7.5 HARVEYS LAKE
T/HARVEYS LAKE
HWY 415 BRDG IN LAKTON
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	09 50		0.088	2.100	0.072	0.012	0.025
73/06/17	10 10		0.350	1.100	0.064	0.034	0.065
73/07/21	08 45		0.430	0.690	0.033	0.042	0.065
73/08/25	10 45		0.720	0.820	0.132	0.132	0.250
73/09/22	07 45		0.210	0.780	0.040	0.019	0.035
73/10/27	09 00		0.450	1.250	0.094	0.168	0.350
73/11/17	09 20		0.112	0.350	0.016	0.012	0.012
73/12/16	11 05		0.128	1.100	0.036	0.012	0.015
74/02/09	15 20		0.330	0.200	0.022	0.010	0.015
74/02/12	10 10		0.264	0.800	0.095	0.005K	0.010
74/02/22	11 35		0.330	0.600	0.075	0.100	0.120
74/03/09	09 45		0.440	1.000	0.135	0.010	0.015
74/03/23	09 15		0.128	1.700	0.055	0.005	0.025
74/04/13	09 30		0.068	0.100	0.020	0.010	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

422201
41 20 46.0 076 01 45.0
UNNAMED CREEK
42 7.5 HARVEYS LAKE
T/HARVEYS LAKE
HWY 415 BRDG IN SE SHAWANESE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	10	25	0.150	0.300	0.019	0.014	0.025
73/06/17	10	20	0.252	0.660	0.063	0.038	0.080
73/07/21	08	20	0.168	0.500	0.031	0.040	0.070
73/08/25	10	20	0.176	0.500	0.120	0.032	0.070
73/09/22	08	30	0.260	2.450	0.094	0.019	0.035
73/10/27	09	10	0.052	0.750	0.031	0.050	0.200
73/11/17	09	40	0.084	0.950	0.040	0.012	0.012
73/12/16	11	35	0.410	1.000	0.048	0.016	0.025
74/02/09	15	40	0.640	0.200	0.025	0.020	0.025
74/02/12	09	00	0.144	4.200	0.190	0.005K	0.020
74/02/22	12	10	0.630	1.100	0.160	0.060	0.240
74/03/09	10	20	0.352	0.900	0.070	0.020	0.030
74/03/23	09	20	0.336	0.100	0.030	0.015	0.025
74/04/13	09	40	0.240	0.200	0.020	0.015	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

32